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Duodenum-Preserving Resection of the Head of the Pancreas in Chronic Pancreatitis

A Prospective, Randomized Trial

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Objective
Two techniques of duodenum-preserving resection of the head of the pancreas were compared in a prospective, randomized trial. The technical feasibility and effects on quality of life were assessed.

Summary Background Data
Drainage and resection are the principles of surgery in chronic pancreatitis. The techniques of duodenum-preserving resection of the head of the pancreas as described by Beger and Frey combine both to different degrees. The efficacy of both procedures has not been compared thus far.

Methods
Forty-two patients were allocated randomly to either Beger's (n = 20) or Frey's (n = 22) group. In addition to routine pancreatic diagnostic work-up, a multidimensional psychometric quality-of-life questionnaire and and a pain score were used. Assessment of endocrine and exocrine function included oral glucose tolerance test, serum concentrations of insulin, C-peptide, and HbA_{1c}, as well as fecal chymotrypsin and pancreolauryl test. The interval between symptoms and surgery ranged from 12 months to 12 years, with a mean of 5.7 years. The mean follow-up was 1.5 years.

Results
There was no mortality. Overall morbidity was 14% (20% Beger, 9% Frey). Complications from adjacent organs were resolved definitively in 94% (90% Beger, 100% Frey). A decrease of 95% and 94% of the pain score after Beger's and Frey's procedure, respectively, and an increase of 67% of the overall quality-of-life index in both groups were observed. Endocrine and exocrine function did not differ between both groups.

Conclusions
Both techniques of duodenum-preserving resection of the head of the pancreas are equally safe and effective with regard to pain relief, improvement of quality of life, and definitive control of complications affecting adjacent organs. Neither procedure leads to further deterioration of endocrine and exocrine pancreatic function.

Patients with chronic pancreatitis characterized by severe pain pose a therapeutic challenge.[1] The impact of surgery in chronic pancreatitis has been discussed controversially.[1,2] Based on studies on the natural history of chronic pancreatitis, it was hypothesized that eventually, most patients will become pain free with progressive "burning out" of the organ.[2] Therefore, a conservative approach has been proposed. However, in a recently published study based on a larger population observed for a longer follow-up, pain alleviation did not occur in more than 50% of the patients while the disease progressed.[3] Considering the impact of the "burning out" process on the patient and society, therapeutic conservatism may not be the appropriate approach. Whether surgery is superior, and if so, which procedure, remains unclear.

In nearly one third of patients with chronic pancreatitis, an inflammatory mass in the head of the pancreas develops, frequently generating complications of adjacent organs, e.g., common bile duct stenosis and duodenal stenosis.[4] In these patients, partial pancreatoduodenectomy represents the most commonly employed operative procedure. The sacrifice of otherwise not diseased organs—i.e., distal stomach, duodenum, and bile duct—is the major disadvantage of this procedure. Duodenum-preserving resection of the head of the pancreas was introduced by Beger.[5] This procedure includes subtotal resection of the pancreatic head, sparing the stomach, duodenum, and common bile duct, while reliably providing pain relief. A modification of the Partington-Rochelle procedure, which also resects most of the pancreatic head while it preserves the duodenum, recently has been promoted.[6] This modified duodenum-preserving resection of the head of the pancreas is claimed to provide equally effective pain relief and control of pancreatitis-associated complications, while considered to be technically easier.

To compare both techniques of duodenum-preserving resection of the head of the pancreas with regard to complete pain relief, definitive control of organ complications arising from adjacent organs, and improvement of the patient's quality of life, a prospective, randomized study was devised.

PATIENTS AND METHODS

The protocol was approved by the Ethics and Research Committee of the Hamburg Medical Association. Since January 1992, a consecutive series of 46 patients (34 men and 12 women) with chronic pancreatitis were allocated randomly to either Beger's or Frey's group.

Inclusion criteria were an inflammatory mass in the head of the pancreas (>35 mm in diameter), severe recurrent pain attacks (at least one per month requiring opiates), history of pain attacks for at least 1 year, or co-existing complications from adjacent organs (e.g., common bile duct stenosis, duodenal stenosis). Disease-related exclusion criteria were chronic pancreatitis without involvement of the pancreatic head, pseudocysts without duct pathology, and portal vein thrombosis. Patient-related exclusion criteria were myocardial infarction within 6 months, detection of a malignant pancreatic tumor, and co-existing malignancy of other organs.

All patients were seen by a panel of gastroenterologists and surgeons, who decided on the indication for surgery. During work-up or conservative treatment, the patients had undergone a median of 5 endoscopic retrograde cholangiopancreatographies (range 1–19, excluding the patients with duodenal stenosis). During a median period of 12 weeks, conservative treatment, including endoscopic drainage and extracorporeal shock wave lithotripsy (ESWL), had failed to provide pain relief for 31 patients. The remaining 15 patients primarily underwent surgery because conservative treatment modalities were considered inappropriate. Surgery was indicated because of recurrent intractable pain in all patients. Four of the 46 patients were excluded after entry because adenocarcinoma was found intraoperatively on frozen section analysis. In these patients, surgery was delayed for 3 to 8 months because of conservative treatment, including endoscopic drainage or ESWL.

The mean interval between symptoms and surgical intervention was 5.7 ± 2.1 years. Etiology was alcohol over-indulgence in 30 patients, blunt pancreatic trauma in 1 patient and iatrogenesis in 1 patient. The latter had undergone endoscopic resection of a papillary adenoma with subsequent scarring of the papilla before development of pancreatitis. In the remaining 10 patients, etiology remained unknown, and pancreatitis was considered to be of idiopathic origin. There was no significant difference between the two groups with regard to age, sex, and distribution of pathologic findings (Table 1). All patients were re-assessed in the outpatient clinic at 6-month intervals.

An inflammatory mass in the head of the pancreas was visualized in all patients. On sonography and computed tomography scan, the maximal diameter of the pancreatic head measured more than 50 mm in 69% of patients, varying from 41 to 126 mm. In seven patients who presented with recurrent emesis, duodenal stenosis was endoscopically shown. After 4 weeks of total parenteral nutrition, the duodenal obstruction had not ceased spontaneously, as demonstrated by hypotonic duodenography. According to the Cambridge classification,[7] endoscopic

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Table 1. CLINICAL CHARACTERISTICS OF THE STUDY POPULATION*

	Beger Procedure (n = 20)	Frey Procedure (n = 22)
Age (yrs, mean ± SD)	45.3 ± 8.1	44.1 ± 5.9
Sex (m/f)	15/5	16/6
Etiology (no. of patients)		
ETOH	13	17
Traumatic	1	0
Iatrogenic	0	1
Idiopathic	6	4
Pain (for at least 12 months, no. of patients)	20	22
Time since onset of symptoms (yrs, mean ± SD)	5.9 ± 2.5	6.4 ± 2.8
Loss of body weight (>8%, no. of patients)	19	20
Inflammatory mass in the pancreatic head (no. of patients)		
>35 mm	6	5
>50 mm	8	9
>70 mm	6	6
Pseudocysts		
>30 mm	6	7
>50 mm	3	4
Common bile duct stenosis (no. of patients)	15	13
Segmental duodenal stenosis (no. of patients)	4	3
Segmental portal hypertension (no. of patients)	6	5
Diabetes mellitus (no. of patients)	9	8
Inability to work (>6 months) (no. of patients)	16	17

* Both patient groups are comparable in terms of incidence of complications from adjacent organs, pancreatic morphology, and clinical features.

retrograde pancreatography revealed pancreatic duct lesions attributed to stage I in 4, stage II in 12, and stage III in 19 patients. Because of duodenal stenosis, endoscopic retrograde cholangiopancreatography could not be performed in seven patients. Twenty-eight patients suffered from common bile duct stenosis, as indicated by ERC, sonography, and laboratory findings. In 11 patients, angiography showed compression of the portal vein, suggestive of segmental portal hypertension.

Exocrine pancreatic function was assessed by estimation of fecal chymotrypsin concentration (normal > 40 μg/g feces, pathologic < 40 μg/g feces)[2] and the pancreolauryl test (normal > 30%, intermediate 20 to 30%, pathologic < 20%)[8] (Table 2).

Endocrine pancreatic function was assessed by the need to treat diabetes mellitus with diet modification, oral hypoglycemic agents, or insulin. Furthermore, fastened serum insulin- (normal < 10 μE/mL, pathologic > 10 μE/mL) and C-peptide levels (normal < 0.7–3.0 ng/mL, pathologic > 3.0 ng/mL), as well as HbA_{1c} concentrations (normal < 4.5–6.0%, pathologic > 6.0%) were determined. In all patients who were not insulin dependent, an oral glucose tolerance test was performed, and results were classified into normal, impaired oral glucose tolerance test, or diabetes mellitus according to the criteria set by the 1985 WHO Study Group on Diabetes Mellitus[9] (Table 3).

Pain intensity was estimated employing a recently suggested pain scoring system, which includes a visual analog scale, frequency of pain attacks, analgesic medication, and the time of disease related inability to work (Table 4).[10] In addition, the European Organization for Research and Treatment of Cancer (EORTC) quality-of-life questionnaire[11] was self-assessed by the patients. It comprises different single and multitrait scales on symptoms, physical status, working ability, emotional, cognitive, and social functioning, as well as a global quality-of-life scale (Tables 5 and 6). The EORTC quality-of-life questionnaire previously had been validated for patients suffering from chronic pancreatitis.[10]

Beger's and Frey's procedures were performed in 20 and 22 patients, respectively (Figs. 1A–1B and 2A–2B). Histopathologic examination of the resected specimen confirmed chronic pancreatitis in all patients.

Statistical Analysis

The primary and main criteria for assessment were 1) complete pain relief; 2) improvement of the patients quality of life, assessed by the EORTC questionnaire; 3) definitive control of problems arising from complications of adjacent organs. Secondary criteria were the postoperative mortality and morbidity rates, postoperative exocrine and endocrine pancreatic function, and occupational rehabilitation.

The results of parametric data are expressed as means ± standard deviation (SD). Nonparametric data are expressed as medians. Statistical significance was estimated using the Student t test, Wilcoxon's rank test, or the chi square test, as appropriate. The level of significance was set to $p < 0.05$.

RESULTS

There was no 30-day mortality. The mean operation time was 325 ± 77 minutes in Beger's group and 289 ± 89 minutes in Frey's group (not significant [NS]). The mean number of transfused blood units was 3.83 ± 2.4 in the Beger group and 2.49 ± 2.3 in the Frey group (NS),

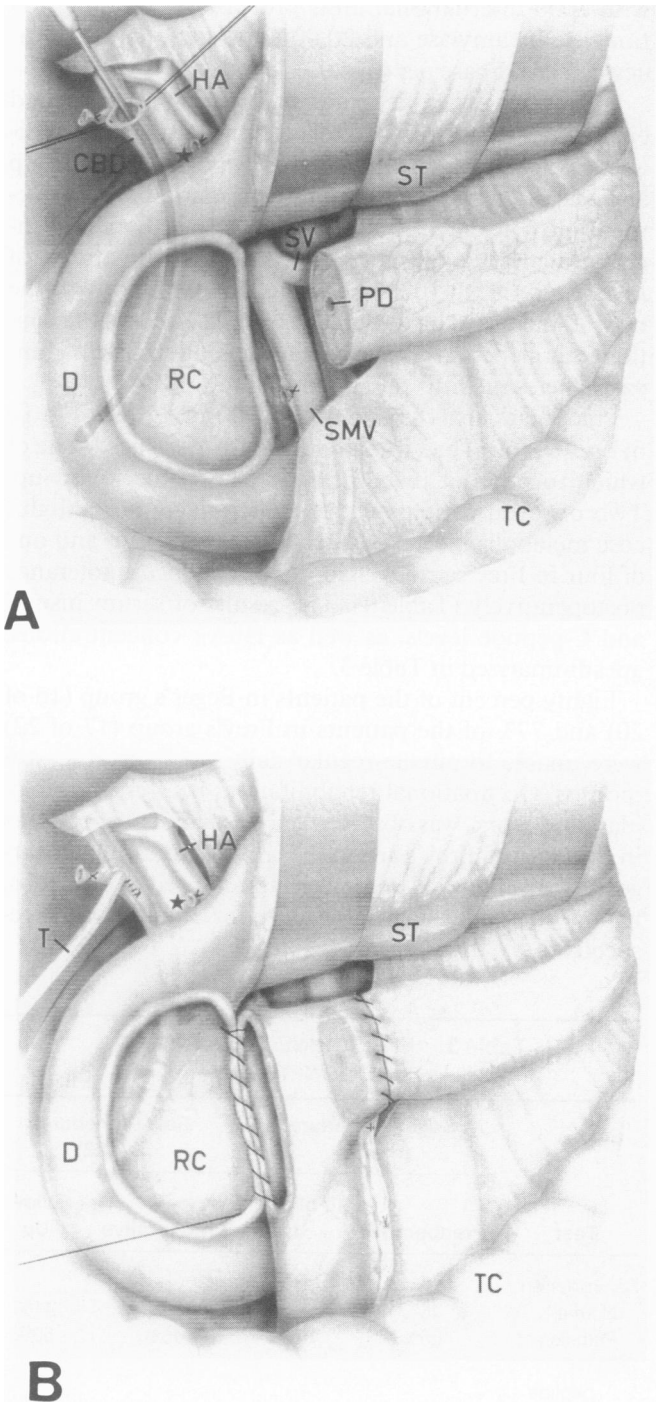

Figure 1. (A) Duodenum-preserving resection of the head of the pancreas as described by Beger. Through a proximal choledochotomy, a metal probe is inserted into the duodenum. (B) Reconstruction with an end-to-end pancreaticojejunostomy with the corpus and a side-to-side pancreatojejunostomy to the resection cavity of the pancreatic head as described by Beger. (CBD = common bile duct; HA = hepatic artery; ST = stomach; D = duodenum; SV = splenic vein; PD = pancreatic duct; RC = resection cavity of the head of the pancreas; SMV = superior mesenteric vein; TC = transverse colon; T = T tube; * = stump of the gastroduodenal artery).

respectively. The overall morbidity was 20% in Beger's group and 9% in Frey's group ($p < 0.05$). All postoperative complications (Table 7) were controlled conserva-

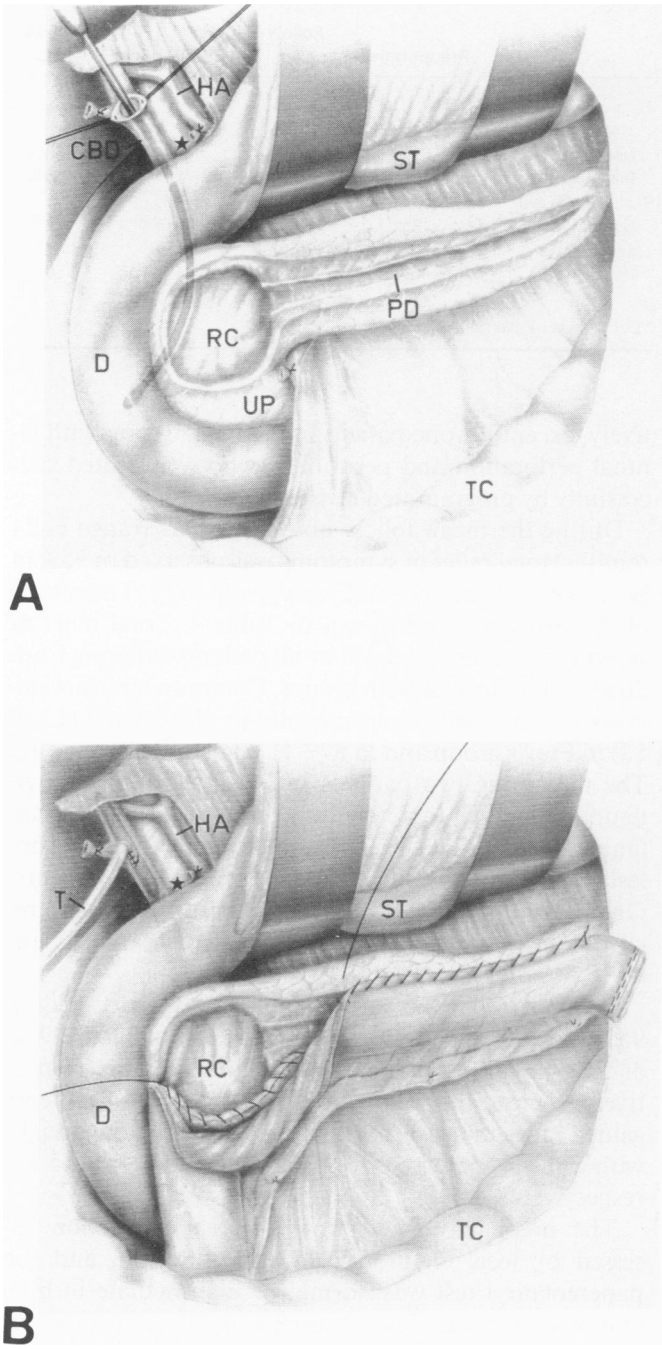

Figure 2. Duodenum-preserving resection of the head of the pancreas as described by Frey. Through a proximal choledochotomy, a metal probe is inserted into the duodenum. (B) Reconstruction with a longitudinal side-to-side pancreatojejunostomy, including the resection cavitiy of the pancreatic head, as described by Frey. (CBD = common bile duct; HA = hepatic artery; ST = stomach; D = duodenum; PD = pancreatic duct; RC = resection cavity of the head of the pancreas; UP = uncinate process; TC = transverse colon; T = T tube; * = stump of the gastroduodenal artery).

Table 2. EXOCRINE PANCREATIC FUNCTION TESTS

	Beger Procedure (n = 20)		Frey Procedure (n = 22)	
	Preoperative	Follow-Up	Preoperative	Follow-Up
Fecal chymotrypsin test				
Normal*	60%	50%	59%	50%
Pathologic*	40%	50%	41%	50%
Pancreolauryl test				
Normal*	10%	5%	14%	9%
Intermediate*	50%	45%	45%	41%
Pathologic*	40%	50%	41%	50%

* Definition see Patients and Methods.

tively, except for one patient in the Beger group with jejunal perforation and peritonitis, who was treated successfully by programmed lavage.

During the mean follow-up of 1.5 years (range 6–24 months) total relief of symptoms was observed in 95% in Beger's group and 89% in Frey's group (NS). The results of the pain score are shown in Table 4. Total relief of symptoms was experienced by all patients suffering from duodenal stenosis in both groups. Common bile duct stenosis was controlled permanently in all patients (13 of 13) in Frey's group and in 87% (13/15) in Beger's group. The remaining two patients in Beger's group required temporary endoscopic stenting because of cholestasis. One of these patients went on to develop recurrent cholestasis and underwent partial pancreatoduodenectomy. One patient in Frey's group with persisting pain and recurrence of pancreatitis in the tail of the pancreas underwent distal pancreatectomy.

Before surgery, the body weight loss exceeded 5 kg in 95% and 91% of patients with a mean loss of 8.9 ± 2.9 kg and 8.5 ± 3.2 kg in Beger's and Frey's group, respectively. During the follow-up, 90% and 77% of patients gained more than 10% of their preoperative body weight with a mean increase of 6.7 ± 2.1 kg and 6.4 ± 2.5 kg, respectively.

The preoperative exocrine pancreatic function assessed by fecal chymotrypsin concentration, and the pancreolauryl test was normal or intermediate in 60% and 59% and pathologic in 40% and 41% of patients in Beger's and Frey's group, respectively (Table 2). The patients with pathologic exocrine function were substituted exocrine pancreatic enzymes preoperatively. During follow-up, two patients from each group turned to pathologic values. In the remaining patients of both groups, exocrine pancreatic function was stable. All patients with pathologic exocrine pancreatic function received a porcine pancreatic enzyme preparation (3 × 2 capsulae daily with 1000 international units protease, 18,000 international units amylase and 20,000 international units triacylglycerol-lipase per capsula).

Preoperatively, nine patients in Beger's group and eight patients in Frey's group were insulin-dependent diabetics. Although three patients (two of Beger's group and one of Frey's group) exhibited remarkable improvement of their diabetic status (saving 16, 20, and 24 international units of insulin per day), in two patients of Beger's group, the diabetic status deteriorated with the need of increased insulin medication (20 and 24 international units per day). The remaining patients with clinical diabetes mellitus remained stable.

Preoperatively, 18 patients (8 of Beger's group and 10 of Frey's group) had impaired glucose tolerance, none of which turned out to be diabetic during the follow-up. Two of seven patients with preoperatively normal glucose metabolism (one of three in Beger's group and one of four in Frey's group) had impaired glucose tolerance postoperatively (Table 4). The results of serum insulin and C-peptide levels, as well as HbA_{1c} concentrations, are summarized in Table 3.

Eighty percent of the patients in Beger's group (16 of 20) and 77% of the patients in Frey's group (17 of 22) were unable to pursue regular daily work for at least 6 months. Occupational rehabilitation, i.e., return to regular daily work, was observed in 70% and 68% of patients in Beger's and Frey's group (NS), respectively. After surgery, two patients of Beger's group returned to their jobs, having survived on social welfare for 2 and 4 years, respectively.

Table 3. ENDOCRINE PANCREATIC FUNCTION TESTS

	Beger Procedure (n = 20)		Frey Procedure (n = 22)	
Test	Preoperative	Follow-Up	Preoperative	Follow-Up
Serum-insulin				
Normal*	45%	35%	55%	41%
Pathologic*	55%	65%	45%	59%
Serum-C-peptide				
Normal*	45%	35%	55%	41%
Pathologic*	55%	65%	45%	59%
HbA_{1c}				
Normal*	55%	65%	64%	68%
Pathologic*	45%	35%	36%	32%
OGTT				
Normal*	15%	10%	19%	14%
Impaired*	40%	45%	45%	50%
Pathologic*	45%	45%	36%	36%

* Definition see Patients and Methods.
OGTT = Oral glucose tolerance test.

Table 4. PAIN SCORE

Criterion	Beger Procedure (n = 20)		Frey Procedure (n = 22)	
	Preoperative Score (Median)	Follow-Up Score (Median)	Preoperative Score (Median)	Follow-Up Score (Median
Pain visual analog scale	82	12 ($p < 0.001$)	79	16 ($p < 0.001$)
Frequency of pain attacks	75	0 ($p < 0.001$)	75	0 ($p < 0.001$)
Pain medication	17	0 ($p < 0.001$)	17	0 ($p < 0.001$)
Inability to work	75	0 ($p < 0.001$)	75	0 ($p < 0.001$)
Pain score*	62.25	3 ($p < 0.001$)	61.5	4 ($p < 0.001$)

* The pain score was defined as the sum of the rank values of the four criteria divided by four.

Postoperatively, three patients admitted continued alcohol abuse according to the criteria defined by Lankisch et al.[3] In another five patients who did not acknowledge alcohol consumption, strong suspicion of continued drinking was based on communication with close relatives and referring physicians.

During follow-up, the global quality-of-life and working ability scores improved by 67% and 50% in both groups. Physical status, and emotional and social functioning improved by 46% and 38%, 69% and 64%, and 60% and 80% in Beger's and Frey's group (NS), respectively (Table 5). The results of the symptom scales are summarized in Table 6. Except for fatigue, which improved significantly ($p < 0.05$) more in Beger's group, the prevalence of the symptoms was not significantly different in both groups.

DISCUSSION

Current therapeutic options in conservative and operative treatment of chronic pancreatitis mainly address the symptoms and eventually, the evolving complications of the disease. Surgery has been challenged by a variety of different therapeutic modalities—endoscopic drainage, ESWL—which have been introduced during the last decade.[12,13] Endoscopic drainage and ESWL are considered appropriate therapeutic options in pancreatic abnormalities restricted to the main duct.[12,13] However, this finding is uncommon.[3,7] Furthermore, stent occlusion, stent dislocation, and pancreatic duct obstruction by stone fragments are major problems of these modalities. Long-term results of endoscopic pancreatic drainage and ESWL are pending. In addition, long-term treatment with endoscopic drainage and ESWL in these mostly young patients also is questionable for socioeconomic reasons. The need for repeat procedures, as depicted by our experience with primary interventional treatment, may delay social and occupational rehabilitation.

Only surgical procedures have been proven to provide lasting pain relief thus far.[3,14,15] The indications for surgical intervention are intractable pain; complications related to adjacent organs; endoscopically, not permanently, controlled pancreatic pseudocysts in conjunction with ductal pathology; and conservatively intractable internal pancreatic fistula.[1,3,16] Occasionally, the inability to exclude pancreatic cancer, despite broad diagnostic work-up, also requires surgery.[15] The ideal surgical ap-

Table 5. QUALITY-OF-LIFE ASSESSMENT: FUNCTION SCALES

Functional Scales	Beger Procedure (n = 20)		Frey Procedure (n = 22)	
	Preoperative Score (Median)	Follow-Up Score (Median)	Preoperative Score (Median)	Follow-Up Score (Median)
Physical status	52.4	97.6 ($p < 0.01$)	54.8	88.1 ($p < 0.01$)
Working ability	50.0	100 ($p < 0.01$)	50.0	100 ($p < 0.01$)
Cognitive functioning	50.0	66.6 (NS)	50.0	66.6 (NS)
Emotional functioning	25.5	83.5 ($p < 0.01$)	33.3	91.8 ($p < 0.01$)
Social functioning	33.3	83.5 ($p < 0.01$)	17.0	83.5 ($p < 0.01$)
Global quality of life	28.6	85.7 ($p < 0.01$)	28.6	85.7 ($p < 0.01$)

Preoperative values are compared with follow-up values.

Table 6. QUALITY-OF-LIFE ASSESSMENT: SYMPTOM SCALES

Symptom Scales	Beger Procedure (n = 20)		Frey Procedure (n = 22)	
	Preoperative Score (Median)	Follow-Up Score (Median)	Preoperative Score (Median)	Follow-Up Score (Median)
Fatigue	88.9	22.3 ($p < 0.001$)	77.8	33.3 ($p < 0.01$)
Nausea and vomiting	50.0	16.7 ($p < 0.05$)	50.0	16.7 ($p < 0.05$)
Pain	75.0	4.2 ($p < 0.001$)	79.0	8.3 ($p < 0.001$)
Loss of appetite	66.6	16.7 ($p < 0.01$)	66.6	16.7 ($p < 0.01$)
Dyspnoea	0	0 (NS)	0	0 (NS)
Sleep disturbance	33.3	33.3 (NS)	33.3	33.3 (NS)
Constipation	33.3	33.3 (NS)	33.3	33.3 (NS)
Diarrhea	33.3	0 ($p < 0.05$)	33.3	0 ($p < 0.05$)
Financial strain	0	0 (NS)	0	0 (NS)
Loss of body weight	66.6	0 ($p < 0.001$)	66.6	0 ($p < 0.001$)
Fever	0	0 (NS)	0	0 (NS)
Jaundice	33.3	0 ($p < 0.05$)	33.3	0 ($p < 0.05$)
Bloating	33.3	33.3 (NS)	33.3	33.3 (NS)
Thirst	0	0 (NS)	0	0 (NS)
Pruritus	0	0 (NS)	0	0 (NS)
Treatment strain	71.4	28.6 ($p < 0.001$)	71.4	28.6 ($p < 0.001$)
Hope and confidence	71.4	85.7 (NS)	71.4	85.7 (NS)

Preoperative values are compared with follow-up values.

proach should address all these problems. Based on the hypotheses of pain origin in chronic pancreatitis—perineural inflammation[17] and ductal hypertension[18]—two principles have been introduced to surgery for chronic pancreatitis: drainage and resection. A variety of different procedures has been proposed emphasizing one or the other.[19–22]

A special problem is the development of an inflammatory mass in the head of the pancreas.[4] This inflammatory enlargement of the head of the pancreas is associated with a high incidence of complications of adjacent organs. Endoscopic biliary drainage can be considered to temporarily resolve or prevent jaundice, improving the patient's preoperative condition. It is not recommended for definitive treatment of common bile duct stenosis in chronic pancreatitis. Stent clogging, causing cholangitis and sepsis, and stent displacement, which is seen more frequently in common bile duct stenosis secondary to chronic pancreatitis than in malignant stenosis caused by the changing extent of the inflammatory component, do occur. These complications require a close follow-up and frequent stent replacement (approximately every 5 months). This is acceptable in patients with malignant stenosis, but not in patients with chronic pancreatitis.[23]

Table 7. POSTOPERATIVE COMPLICATIONS

Complication	Beger Procedure (n = 20)	Frey Procedure (n = 22)
Hemorrhage (>3 units of blood postoperatively)	1	1
Pancreatic fistula	1	0
Jejunal perforation and peritonitis	1	0
Bronchopneumonia	1	1
Total	4 ($p < 0.05$)	2

For patients with coexisting complications of adjacent organs, partial pancreatoduodenectomy represents the most commonly employed surgical procedure. Although it provides complete pain relief in up to 80% of patients,[15] the procedure is burdened by high late morbidity and mortality rates.[15,24–26] The sacrifice of otherwise healthy adjacent organs does not seem to be warranted in this benign disease.

On the other hand, drainage procedures supposedly carry a lower morbidity and mortality rate, but fail to provide complete pain relief in up to 60% of patients.[14,27,28] Furthermore, pancreatitis-associated complications of adjacent organs, such as distal common bile duct obstruction and duodenal stenosis, require additional bypass procedures[29,30]; also, carcinoma cannot definitively be ruled out.[31]

The principle of duodenum-preserving resection of the head of the pancreas has been introduced into the treatment of chronic pancreatitis with predominant involvement of the pancreatic head.[5] The original tech-

nique described by Beger[5] includes the transection of the pancreas over the portal vein and subtotal resection of the pancreatic head while peripancreatic organs are being preserved (Fig. 1A–1B). Beger's procedure has been shown to provide complete pain relief in 80% of patients[5,32,33] and to control permanently pancreatitis-associated complications of adjacent organs.[33,34]

The modified procedure described by Frey[6] combines a limited resection of the pancreatic head with a longitudinal pancreaticojejunostomy performed according to the Partington-Rochelle technique (Fig. 2A–2B).[20] The experience with this modification has been limited so far.[6,35] It is considered easier, with regard to technical feasibility, than Beger's procedure, in which in contrast resection is more extensive. Furthermore, definitive control of associated complications involving adjacent organs also has been claimed to be provided by Frey's procedure.[35] To evaluate the efficacy of both techniques of duodenum-preserving resection of the head of the pancreas, this prospective, randomized trial was conducted.

Although mortality rates were zero for both techniques, postoperative morbidity was significantly lower in patients who had undergone Frey's procedure (Frey group, 9% *vs.* Beger group, 20%). Both procedures provided permanent control of problems arising from associated complications of adjacent organs in the majority of patients. Furthermore, both techniques equally allowed histologic verification of the dignity of the mass in the head of the pancreas. Thus, none of the patients with pathohistologic diagnosis of chronic pancreatitis had pancreatic carcinoma during follow-up. On the other hand, pancreatic carcinoma was detected during surgery in four patients (two in each group), despite extensive diagnostic work-up. This diagnostic problem, which has been reported previously,[15,31] must be considered another major drawback of any conservative treatment modalities. Tracing pancreatic carcinoma while digging out the pancreatic head might be a problem because tumor spillage can occur. This risk must be weighed against the benefits of the procedure in 90% of patients without carcinoma.

In studies on chronic pancreatitis, analysis of pain was done by rather gross scales thus far.[3,5,6] To quantify pain intensity more distinctly, a pain score comprising a visual analog scale of pain, frequency of pain attacks, and pain-related sick leave, as well as analgesic medication, recently has been suggested.[10] Pain, however, reflects only one aspect of sensitive and functional aspects of day-to-day living. Assessment of the quality of life by standardized psychometric measures, first introduced in the evaluation of outcome in cancer treatment,[36] seems to be mandatory in evaluation of therapeutic strategies in chronic pancreatitis. Recently, we have validated the EORTC quality-of-life questionnaire for patients with chronic pancreatitis.[10]

Both procedures proved to be equally effective with regard to complete pain relief. In both groups, the patient's overall quality of life increased considerably. Relief of symptoms, especially of pain, fatigue, and loss of body weight, accounted for improvement of the physical status, working ability, and emotional and social functioning. In the majority of patients, both procedures did not deteriorate exocrine and endocrine pancreatic function. This favorable result is reflected by the fact that occupational rehabilitation was achieved in 70% of patients in Beger's group and in 68% of patients Frey's group. Furthermore, 73% of patients with chronic pancreatitis of alcoholic origin have discontinued drinking.

It must be mentioned, however, that the data presented here reflect only the short-term results, i.e., within a mean follow-up of 1.5 years. To determine the long-term efficacy of both procedures, a longer follow-up of at least 5 years is necessary. Therefore, we are reluctant to recommend either one of the duodenum-preserving resections of the head of the pancreas at this point.

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